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Genes for Tomorrow

Plant explorers are running a critical race against time. Their goal: collect as many of the world's primitive and wild plants as possible in the next 10 years. By then, scientists fear, much important uncollected germ plasm will be lost.

Everywhere the march of progress, especially in developing countries, is decimating plant communities. Bulldozers uproot valuable species in the building of towns, roads, factories, and airports. Dams drown ancient habitats. Goats graze many plants out of existence. And primitive varieties such as melons, once grown in rich diversity for local peasant marketplaces in Asia, are no more, their place taken by a few super varieties adapted to broad regions.

Civilization depends upon crop plants that are grown far from their centers of origin. Paradoxically, of all the major crop plants making up the bounty of U.S. agriculture, not one originated within our borders. Our complex agricultural system rests entirely on introduced plants that had been nurtured and dispersed over the centuries by farmers and plant breeders.

Valuable germ plasm has also been collected by USDA plant explorers who since 1898 have made over 150 global collecting expeditions and introduced some 350,000 collections. Many collections were put to good use but were eventually discarded so that today we retain about one-tenth of the early introductions in their original form.

Since World War II, however, scientists have made great strides in perpetuating germ plasm. World collections of major crops have been assembled, including several maintained by ARS. ARS also maintains a living reserve of germ plasm at the National Seed Storage Laboratory, Fort Collins, Colo., where 78,000 lines of crop seeds are housed. This facility stands ready to replenish depleted working collections anywhere. The scientific community is working hard to establish a global network for the long-term preservation of germ plasm.

We need these germ plasm reserves to remedy many agricultural problems brought on by pollution, dwindling water supplies, and the necessity for biological control methods that incorporate varietal resistance against insects and pests. Looking further ahead, we may find that many of today's noneconomic plants could become crops of tomorrow, furnishing fiber, medicinals, materials for tanning and dyeing, ingredients for industry, and perhaps even foods and feeds as future economic needs or people's preferences may dictate. Perhaps most important of all in these times of ecological concern, the preservation of threatened plants may contribute towards maintaining complexity and diversity of species, qualities that characterize healthy and stable ecosystems.

Editor: R. P. Kaniuka
Managing Editor: E. H. Davis

Contributors to this issue:

R. C. Bjork, V. M. Dryden, A. J. Feeney, C. E. Herron, L. W. Lindemer, W. W. Martin, E. L. Razinsky, N. E. Roberts, D. M. Webb, L. C. Yarris

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COVER: Mr. Camirand checks uni-flow filter installed at the Pinole, Calif., municipal sewage treatment plant (page 3). The hoses filter raw sewage to which lime is added to precipitate out some unfilterable solids and to improve efficiency. Cooperation of the Pinole city government enabled ARS scientists to test the filter under actual conditions (371X219–15).

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Clifford M. Hardin, Secretary
U.S. Department of Agriculture

G. W. Irving, Jr., Administrator
Agricultural Research Service

Garden hose pollution curb?

A LOW-COST experimental filtering system may help solve pollution problems where the main task is to remove undissolved solid particles from water.

Chemist Karel Popper invented the system, called the uni-flow filter. He describes it as "a poor man's filter," because the key part is an ordinary cotton garden soaker hose—the type of hose many homeowners use for slow irrigation of their gardens.

Dr. Popper and chemist Wayne M. Camirand have conducted preliminary development research at the ARS Western regional research laboratory, Berkeley, Calif.

"Undissolved solid particles are the

Dr. Popper examines the filtrate from the uniflow filter, which removed more than 99 percent of the suspended solids in raw sewage in only a few minutes. Suspended solids are usually removed in settling tanks, an expensive process requiring several hours (371X219–11).

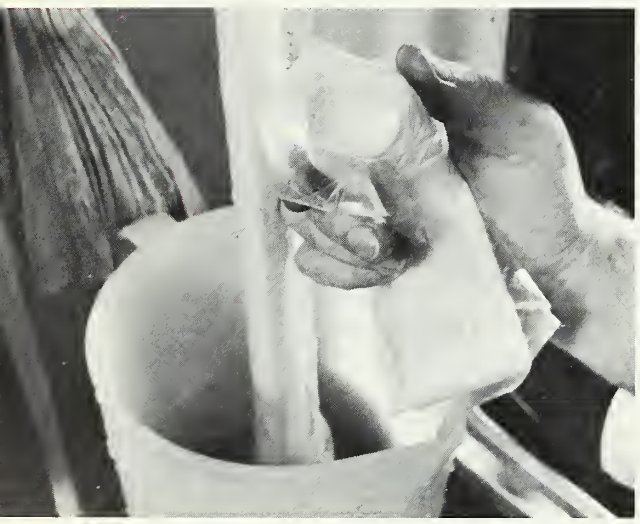
main pollutants in many effluents," Dr. Popper says, "and the primary treatment task to be carried out is removal of the solids from the water. It seemed obvious to us that a tool to do this job at low investment cost and low operation cost would have many applications, and the uni-flow filter is our proposal for such a tool."

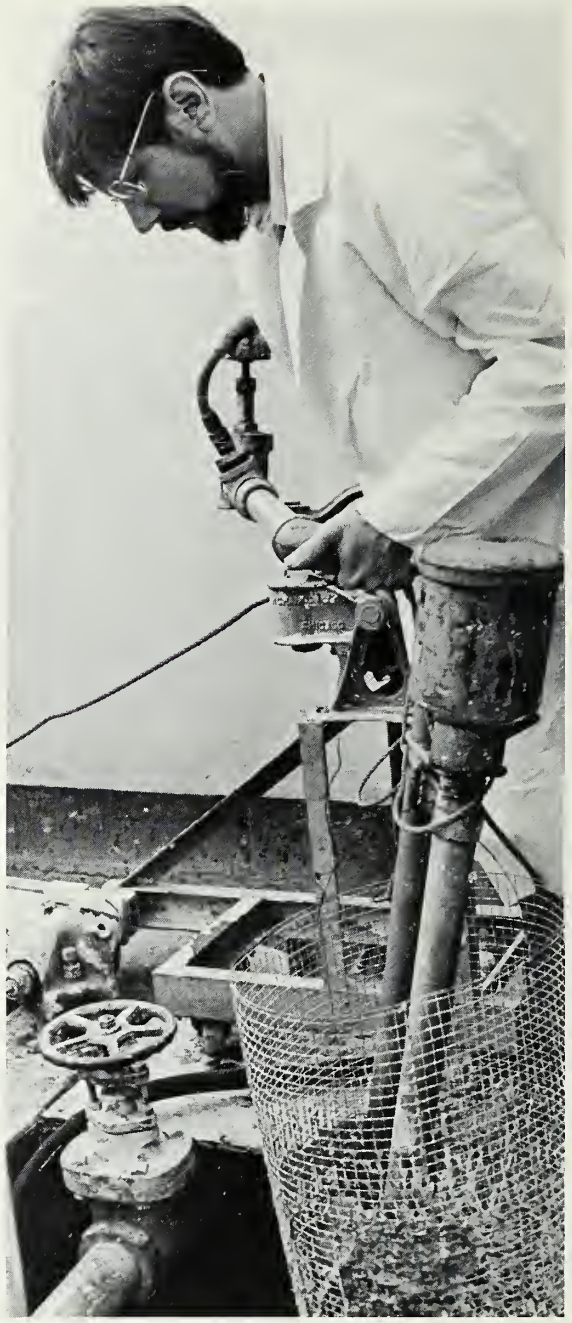
The entire filtering system consists of several parts other than cotton hoses. But the separation of solids from liquids, which is the purpose of filtering, takes place in the hoses.

The versatility of the unit has been demonstrated in tests in which it:

- Removed polluting chemicals from the effluent discharged during the regeneration of water softeners and recovered salt brine for reuse.
- Removed 92 percent of the solids from raw sewage in a municipal sewage plant, after the sewage had been mechanically mixed to reduce solids to fine particles. Experiments in the laboratory indicate that if lime is first added to sewage, the filter will remove more than 99 percent of the solids.

Current research is determining further the potential of the system. Now under study, for example, is how filter performance for various slurries is affected by changing the type of hose material, pressure, flow rate, size of hose, and mode of operation, that is, straight through or recirculating. □

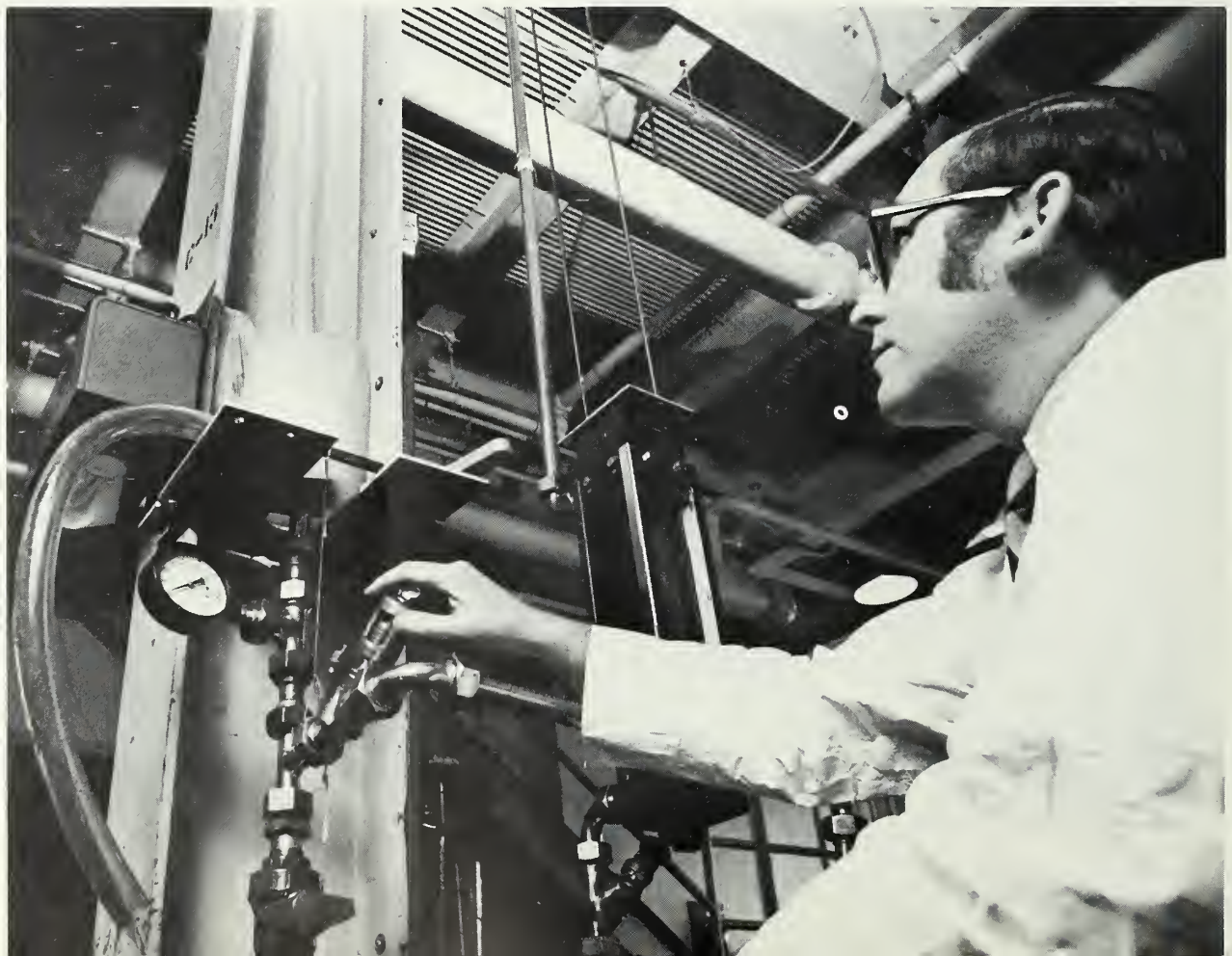




Before sewage is fed into the top of the filter, it goes through this wire screen, which removes stones and other large objects that would not pass through hoses (371X219–20).

***Left:** Polypropylene is one type of material currently being tested to compare its filtering efficiency with that of cotton (371X219–38).*

***Below:** Chemical engineer J. Peter Clark adjusts sludge recycling rate. Cycling sludge through the filter more than once permits more efficient filtering of some slurries (371X219–41).*



Typical Matanuska Valley countryside where farmers must contend with a short growing season, poor soils, and high investment costs (National Geographic Society photo by George F. Mobley).

Advancing Agriculture in Alaska

FINDING A WAY to control warbles on Arctic reindeer herds . . . recommending grasses for revegetating an 800-mile right-of-way of the proposed oil pipeline . . . solving soil fertility problems that limit productivity of native grasslands—all are part of the work of the only U.S. research station devoted to subarctic agriculture.

ARS and cooperating Alaska Agricultural Experiment Station scientists at Palmer often face unique research challenges as they provide knowledge needed to expand food production under climatic and economic conditions found nowhere else in the United States. The average frost-free period averages 89 to 110 days. Soils are generally low in fertility, and the usual 12 to 24 inches of annual precipitation is concentrated in late summer and fall. Farmers' investment costs run 1½ times those in the lower 48 States. Local agricultural marketing and processing facilities are minimal.

But Alaska's potential for agricultural development is immense. While the State produces only 4 percent of its food and crops only 17,000 acres, some 2,600,000 more acres are suitable for cultivation and 10,500,000 could be grazed, not counting 30 million acres of reindeer range. Plants carry on photosynthesis up to 20 hours daily in May and June. And some insect vectors of plant diseases pose little threat because the disease organisms are absent.

The project to control warbles, insect pests of some mammals, illustrates one of the more unusual research needs of subarctic agriculture. Natives above the Arctic Circle and along Alaska's western coast, exclusive owners of the herds, depend upon reindeer for both meat and hides. ARS entomologist Richard H. Washburn found in experiments that intramuscular injections of famphur and fenthion in reindeer in the fall, after the warbles have laid eggs, provide effective control.

Other studies by Dr. Washburn show that spray applications of pyrethrum with piperonyl butoxide synergist inhibit egg-laying by blowflies on drying fish, an important native food. Both pesticide uses are experimental and not registered.

Grass and legume breeding for Alaska is heavily dependent upon plant materials from the high latitudes of the Scandinavian countries and Siberia, along with native Alaskan species. Identifying grasses potentially useful in breeding programs is an objective of ARS agronomist Leslie J. Klebesadel.

He points out that most perennial forage species from the "outside" are not adapted to the rapidly shortening photoperiod of late summer. Because

plants "don't know when to go dormant," they don't store food reserves or develop cell conditions tolerant to freezing and so do not survive.

Dr. Klebesadel is also working with two promising alfalfas, one of whose parents is a northern-adapted alfalfa introduced from Siberia in the 1890's by USDA plant explorer Niels Hansen.

ARS-Alaska forage research may make an unexpected contribution to environmental protection if the proposed oil pipeline is built from the Arctic Ocean to the Gulf of Alaska. And Alaskan agriculture will benefit from establishment of a source of adapted grass seed. Of the 1½ million pounds of seed that a consortium proposes to buy through the Alaska Crop Improvement Association, more than 1 million pounds would be of varieties bred or released at Palmer. These include locally developed Polar brome, Arctared fescue, and Nugget Kentucky bluegrass as well as Engmo timothy, a Norwegian variety released by the Station.

In other research with forages, ARS soil scientists Winston M. Laughlin and Paul F. Martin found that micronutrient deficiencies are limiting yields. The scientists showed the need for sulfur on bromegrass when natural sulfur sources were depleted, and Dr. Laughlin last year began evaluating brome response to sulfur supplied in several forms. Another study indicated that molybdenum and boron are needed for native grasslands on islands off the Kenai Peninsula.

Earlier research by the two scientists indicated that deficiencies of nitrogen, phosphorus, and potassium generally limit maximum crop yield. What was popularly believed to be fertilizer burn proved to be serious potassium deficiency that showed symptoms unlike those described elsewhere.

Like forages, cereals for Alaska are heavily dependent upon Scandinavian sources. ARS agronomist Roscoe L. Taylor supervises the farthest north planting of the International Spring Wheat Nursery. He says most varieties in this testing program cannot be used in Alaska because of too-late maturity.

Dr. Taylor is increasing seed of a new barley and two new oats for release. The barley would be a replacement for the Scandinavian Edda variety, which yields well but lodges and shatters badly.

Although early-maturing vegetables from the other mainland States can be grown in Alaska, ARS horticultural research is seeking ways to minimize the limitations of short season and remove obstacles to commercial vegetable production.

The Alaska Frostless potato, released in 1969, has "more frost resistance than a plant breeder could expect to encounter in a lifetime," says ARS horticulturist Curtis H. Dearborn, its developer. Nearly mature vines withstand 30° F. in the field for 2 hours and briefer exposures as low as 28° F. Dr. Dearborn's investigation of why potatoes tuberize may eventually cut 7 to 10 days from the needed growing season, making potato production practical as far north as the Yukon River.

Finding new markets is another goal, but a 3-year pilot research project suggests that a vegetable processing and freezing industry would be feasible in the Matanuska Valley. ARS economist Charles F. Marsh believes

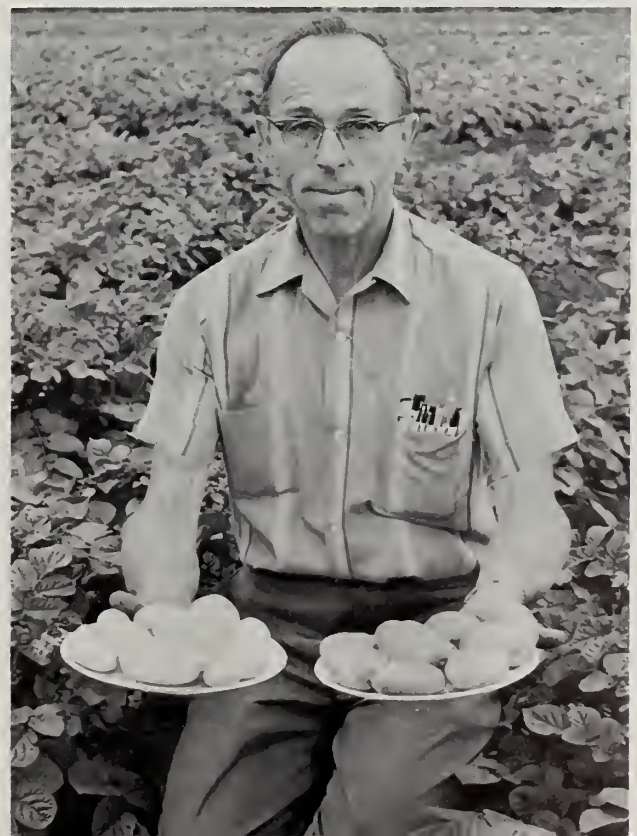
Far left: *Dr. Laughlin and laboratory aide Kathryn Kincaid examine response of Romaine lettuce seedlings to applied phosphorus and lime (PN–1961).*

Top left: *Brussels sprouts are checked by Dr. Washburn for root maggot eggs and symptoms of maggot infestation. Unlike other insects of introduced crops this maggot has native hosts in Alaska and is the only crop insect that routinely requires pesticide (PN–1962).*

Bottom left: *Dr. Klebesadel examines seed set in panicles of Polar bromegrass, a variety released by ARS and the station (PN–1963).*

the markets are available. And he found excellent consumer acceptance of locally frozen peas and broccoli in test marketings in major Alaska cities. To be successful, he believes a processing plant will need to handle several products—perhaps peas, broccoli, brussels sprouts, cauliflower, and potatoes—both processed and fresh.

USDA began research in Alaska at a long-abandoned station at Sitka in 1898. The Matanuska Station, established in 1917, was transferred to the Territory of Alaska in 1932. The adjacent Palmer Station was constructed in 1949, and it was transferred to the State in 1967. □



Above: *New barleys under development by Mr. Taylor are selected for lodge and shatter resistance (PN–1964).*

Left: *Dr. Dearborn shows choice tuber selections of his Alaska Frostless potato. Tubers are smooth and white with good flavor and texture (PN–1965).*

Mr. Ronald Douglas makes his rounds to trap locations and replaces the inner cage of female borers with a fresh one (1070C920–23).

Borer traps signal best time to spray

SURVEY TRAPS for the lesser peach tree borer, a destructive pest of peach, cherry, and plum trees, could minimize the need for applying chemical control.

The traps would indicate when the borers have emerged in the spring and provide a basis for estimating the extent and location of infestations. Growers now depend on weather conditions to decide when to begin their annual spray schedule. Although weather is a useful guide to borer emergence, it can be misleading. By providing more precise information, the traps could save growers the expense of several spray applications and offer other potential advantages. Moreover, the traps may eventually serve as a control themselves.

The borer trap technique was developed by ARS entomologists at Vincennes, Ind. Now a pilot program is underway in an isolated area: Washington Island, Wis., in Lake Michigan. The island is sufficiently remote to prevent insects on the mainland from reaching it in numbers large enough to influence trapping test results with the known borer population inhabiting the island.

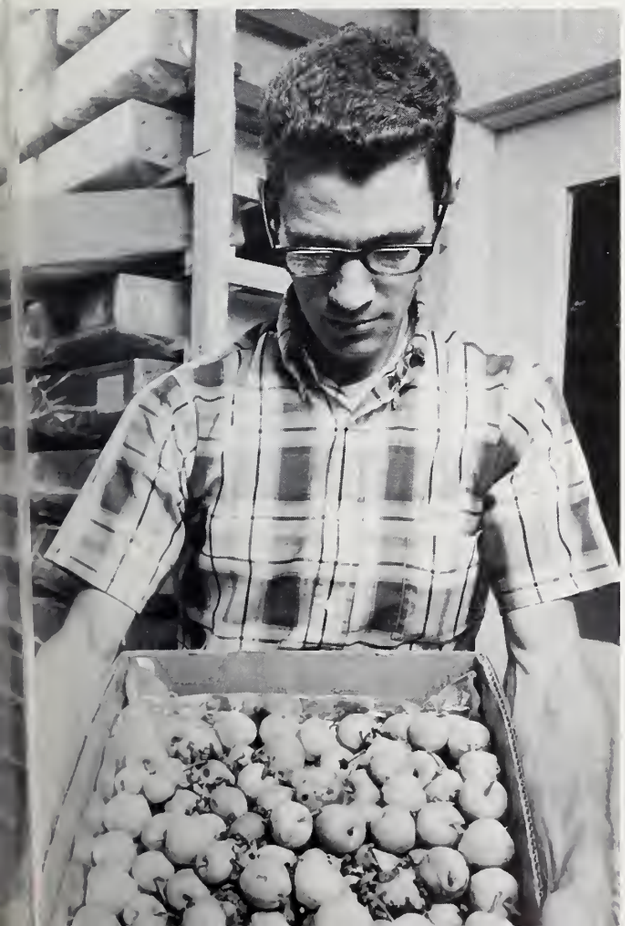
In 1969, the first year of the test, scientists led by Dr. Robert E. Dolphin and Mr. Tim T. Y. Wong placed 30 traps on the 25-square-mile island. Each trap was baited with 12 female borers in cages. Males attracted to the females became entangled in a sticky material coating the sides of the traps and subsequently died without mating. Females in the traps were replaced daily. About 4,000 males were caught during the 4-month season.

Last year, the scientists used 1,000 traps, each baited with 5 to 10 females, and captured 7,800 males during the season, accounting for all but 2,200 of the males estimated in the area. On the basis of these results, this year's intensified program should suppress borer population even more.

To further improve the trapping system, scientists are trying to determine the chemical identity of the substance that female borers produce to attract males. Such information could lead to a synthetic lure more easily handled than live females. □

Left: *On the island, Mr. Thomas Mouzin releases adult male borers that have been sterilized and then dyed with a fluorescent green powder. The sterile males help in checking the program's effectiveness (1070C919–17).*

Below: *Borers lured to the traps are caught in a sticky substance coating the sides. This trap is being checked for sterile males (1070C920–12).*



Left: *At the Vincennes lab, borers are reared to obtain the females for trap lures and males for sterile release. The moist cotton at bottom of this cup contains about 80 eggs which will be placed in larva rearing trays (1070C921–11).*

Left: *The larva trays are packed in plastic bags and stored on racks for shipment to Washington Island (1070C921–25).*

Side-oats grama seeds are placed on moistened blotting paper laid over the two-way plate for the germination trials (371X280–3).

Speeding seed trials

A TIME-SAVING DEVICE for determining optimum seed germination temperatures has stirred the interest of seed-testing organizations with its thoroughness and efficiency.

This device, a two-way thermogradient plate, can evaluate seed performances under various temperature conditions faster and more accurately than the conventional germinators presently in use.

The plate will complement rather than replace the conventional germinators. Once optimum germination temperatures have been indicated on this plate, large-scale tests can be run in standard germinators to obtain the specific light that is necessary for germination in each type of seed.

Developed at Beltsville, Md., by former ARS botanist Arnold L. Larsen, the plate is now being utilized by ARS plant physiologist Darrell F. Cole and technician Dorothy Skaggs. They are determining the best germination conditions for various commercial crop varieties.

The plate, square and made of aluminum, is lined on all four sides with channels for water circulation and covered with a gridded plastic top. Warm and cool water are circulated through parallel channels. At selected time intervals, the temperature gradient is changed by switching the water flow to channels perpendicular to the established gradient. Thus, a continuous range of both constant and alternating temperatures is supplied. The plate is tilted at the same time to reduce air currents.

The gridded plastic top reduces moisture loss from the planting surface and also helps reduce air currents. The temperature range is limited only by the water temperature in each pair of channels. It can be continuously monitored at 24 locations on the plate.

As many as 900 large seeds (corn, soybeans, etc.) or 3,600 small seeds (alfalfa, clover, etc.) can be planted on the plate. Seeds are usually planted on moistened blotting paper, but other germination media can be used. Each seed will have a different combination of temperature conditions. A germination pattern can be quickly calculated by determining the speed of germination at each location on the plate.

A pattern of germination along one diagonal indicates that constant temperatures are required; if the pattern follows the opposite diagonal, the seeds require alternating temperatures.

The two-way thermogradient plate was exhibited at the National Biological Congress, sponsored by the American Institute of Biological Sciences, in Detroit last fall. □

Germinated side-oats grama seeds are counted and their locations scored to determine the most suitable temperature pattern (371X280–2).

Faster test toward VIRUS-FREE CITRUS

A RELATIVELY SIMPLE and inexpensive test recently developed identifies a citrus virus and will help in reducing infections in Florida citrus groves.

The test can be performed in about 12 hours and with little equipment. It requires much less time than present methods and will reduce the cost to growers of certified virus-free stock for use in replacing trees.

Identifying the viruses and reducing the number of infected trees in a grove helps lessen the ever-present threat of a serious epidemic. The recent California epidemic, for instance, killed thousands of citrus trees and raised the price of oranges to the consumer.

Until now, the primary means of identifying citrus viruses has been the indicator-plant method—a slow and arduous procedure requiring numerous plants of the proper age, experienced scientific personnel, and a test period ranging from several months to several years before symptoms can be evaluated. Diagnosis by indicator plants is difficult, at best, since different strains of the same virus may produce different symptoms, and mixed infections often occur.

The new test involves application of serological techniques which were adapted by Dr. Stephen M. Garnsey, ARS plant pathologist and Dr. Dan E. Purcifull, virologist with the Florida Agricultural Experiment Stations, Gainesville. They worked with crinkly-leaf-type virus (CLTV).

Because serological tests are based on the specific reaction between a virus and its antibodies, the scientists first produced a serum with antibodies specific for the virus, called an antiserum. This was done by injecting rabbits with purified CLTV, which caused the buildup of antibodies to the infection. This antiserum was collected. In addition, sap extracts were taken from the leaves of citrus trees to be tested.

The serological test consisted of cutting two small "wells" in a plate of agar (gelatin) and placing the antiserum in one and the leaf extract in the other. As the contents diffused into the gelatin plate, eventually serum and leaf extract met. If the leaf extract contained CLTV, a white line, called a precipitation line, formed. If no line formed, the leaves were free of CLTV or contained different viruses.

The serological test accurately detected the presence or absence of CLTV in 239 citrus trees of differing ages representing 11 varieties. Both fresh green leaves and stored dried leaves were tested successfully by the scientists.

Severe damage to Florida citrus trees, fortunately, has been only local despite the fact that approximately 95 percent of the 100 million citrus trees in Florida have at least one virus and many have combinations of two, three, or four. However, one virus called tristeza has killed about 50 million citrus trees throughout North and South America since 1930.

Today, emphasis is being placed on grafting with tested virus-free stock, since a major source of virus contamination has been the propagation of new citrus trees by grafting from old trees containing viruses. The new test should help to effectively accomplish and speed up this method of pesticide-free cultural control.

In agriculture's continuing battle against crop diseases, it is hoped that, with further research, serological techniques can be used to identify and eliminate other viruses from citrus. □

Dipping sheep in one of the many pesticides approved for the purpose provides most effective control of keds (BN–37940).

Ked control pays off

CONTROL OF KEDS, insect pests of sheep, is easy and economical and should result in heavier animals with higher quality meat, wool, and skins.

The first evidence of ked damage came when ARS scientists established these "sheep ticks" as the cause of a widespread sheepskin leather defect known as cockle (AGR. RES., Feb. 1969, p. 3). Since then, efforts have been underway to put a price tag on the full damage they do.

In tests with 110 clean lambs, Dr. Irwin H. Roberts, veterinarian in charge of the ARS laboratory in Albuquerque, N. Mex., infested half the flock with keds and kept the rest ked-free. At 1 year, all sheep were slaughtered, their carcasses dressed and graded, and the pelts salted and sent to the ARS marketing and nutrition research laboratory, Philadelphia. Here, the wool was removed and the skins pickled. Wool and skins were both evaluated under the direction of microscopist Alfred L. Everett.

After slaughter, ked-free carcasses weighed 1 to 5 pounds more than infested ones, and meat packers in Albuquerque determined that they were worth an average of $1.64 more. A rating of "choice" was given by a meat grader of USDA's Consumer and Marketing Service to 21 of the carcasses from the uninfested group and to only 12 of those from the infested group.

The uninfested animals also had more and better wool. Its staple length was greater and so was the total weight in an analysis of samples made by Dr. Roberts and personnel of the C&MS wool standards laboratory. Post-slaughter examination of the fleeces in Philadelphia showed that those free of keds had a higher percentage of clean wool with less contamination by insect remains and wastes. A more precise experiment on wool value is now underway in New Mexico, with sheep paired on the basis of fleece characteristics.

Turning to evaluations of skins, scientists found them severely marred by the pimple-like blemishes known as cockle, as in earlier tests. Normally, a tanner would have considered them fit for only the cheapest materials, such as shoe linings. But as an experiment, both cockled and undamaged skins were made into suede leather such as for fine garments, a lower-priced grain leather for slipper uppers, and shoe linings. Garment suede from the infested skins was downgraded for cockle by an average of $1.68 per skin (47 percent), and even the slipper upper leather was worth 33 cents less per skin (down 10 percent).

In total, the price advantage for ked-free sheep, even without data on wool improvement, was about $2 to $3.30 as a result of better carcasses and higher quality skins.

How much will it cost sheep producers to get rid of keds? Not more than 50 cents per animal, researchers say, even if the treatment is done commercially. Most effective control is achieved by dipping the sheep in one of the many Federally registered pesticides, such as coumaphos, malathion, or ronnel. Spraying of these compounds is also effective. When animals are few, or if the weather is unusually cold, insecticidal dusts containing pyrethrins or coumaphos may be used.

Keds and pupal case in fleece. Keds, also called sheep ticks, are wingless parasitic flies that irritate animals and cause biting and scratching that damages fleeces (PN–1966).

The treatment is necessary only once a year and can be done at any time from shortly after shearing until the onset of cold weather. The entire flock, lambs included, should be treated. Infested feeder sheep should be treated soon after feedlot operation begins. □

Cattle that commute

COMMUTING CATTLE are helping scientists measure the effects of location change on animal performance.

Results so far indicate that performance at home isn't always a good predictor of how an animal, or its progeny, will do in a new environment.

This long-term ARS project, which began in 1961, involves swapping Hereford cattle between the U.S. Range Livestock Experiment Station, Miles City, Mont., and the Beef Cattle Research Station, Brooksville, Fla.

Objectives of the project are twofold: first, to check genetic changes in cattle compared to relatives back home; then, to determine the importance of adaption to a new location in getting maximum productivity.

At the outset, each station formed an 80- and a 20-cow herd from animals previously located and selected at Miles City and a 50-cow herd from animals originating at Brooksville.

Long-term plan calls for year after year breeding of the 50- and 80-cow herds as closed two- and four-sire herds at each location. The 20-cow herds at each site will be bred to bulls previously used in the 80-cow herds at the opposite location. Each test herd had genetically similar herdmates back at the place of origin, so performance based on genetic changes could be measured.

Results thus far analyzed, for the first 7 years, are preliminary. They do show that performance records for cattle at their place of origin might not apply at some other location for them or their progeny.

At the Montana site, for example, bull calves from herds of Montana origin averaged 18 pounds heavier at weaning than calves of Florida origin. However, Montana bull calves when raised in Florida with Florida calves weaned 45 pounds lighter.

Weaning weight of heifer calves favored the Montana-originating herds by 39 pounds in Montana and the Florida-originating herd by 27 pounds in Florida.

Pattern of yearling weights was similar to that observed at weaning.

The scientists indicated that if this type of interaction holds up in further testing, the beef industry will have to reexamine performance testing and selection procedures. Distribution of breeding stock and semen should also be done with caution until causes for the interactions are found.

The research is being conducted by ARS animal scientists Will T. Butts, Knoxville, Tenn.; O. Floyd Pahnish, Miles City; William C. Burns, Brooksville; Everett J. Warwick, Beltsville, Md.; and animal geneticist Marvin Koger of the Florida Agricultural Experiment Stations, Gainesville. □

The Brooksville cattle at home. Performance on most traits was better in the place of origin (PN–1967).

Mr. Lazar sends diced carrots through a pilot unit. The covers are removed to show pieces moving through the pilot plant blancher (PN–1968).

less pollution, more nutrition

IQB GOOD FOR VEGETABLES

VALUABLE NUTRIENTS leached out of vegetables during blanching with steam or hot water become serious pollutants in the output from processing plants.

But an experimental blanching method can retain up to 90 percent of these nutrients in the food.

The method, called individual quick blanching (IQB), was conceived by engineers Melvin E. Lazar and Daniel F. Farkas at the ARS Western regional research laboratory, Berkeley, Calif. Food engineer Daryl B. Lund collaborated in equipment design and the first laboratory tests at the Berkeley laboratory during a 6-month sabbatical leave from the University of Wisconsin Food Science Department.

The main reasons for blanching are to partially cook the food and stop enzyme activity that would otherwise lower food quality by discoloring it and breaking it down during storage. In conventional processing, vegetable pieces in deep piles or layers are exposed to steam or hot water until enough heat penetrates to the interior of each piece to stop most of the enzyme activity. Exposure times range from 4 to 15 minutes for cut vegetables; more time is required for large chunks.

In IQB, every piece is quickly and uniformly heated because the pieces are spread in a single layer on a belt that conveys them through a steam chamber. And they are held in steam only long enough for partial penetration of heat. Then they are re-piled in deep layers on a slow-moving belt that conveys them through an insulated chamber. There they are held long enough for previously added heat to redistribute and penetrate to the interior of each piece and stop enzyme action. Overcooking of the pieces is thus avoided.

A variation of the method is to partially dry the surfaces of the pieces before blanching. This gives the greatest reduction in blanching effluent, because pieces absorb moisture that normally condenses on surfaces and runs off.

Because only partial heating is desired during the heat-application period in IQB, exposure time in the steam chamber is about one-fourth to one-half that required in conventional blanching.

In pilot-plant tests at the Berkeley laboratory during the 1970 season, IQB was used on carrots, beets, and green beans. Preliminary taste tests rated frozen and cooked IQB carrots better than conventionally blanched carrots because they had a firmer texture. Taste comparisons have not yet been made on other foods.

The pilot-plant unit, with a capacity of 300 pounds per hour, will be shipped to the University of Wisconsin for studies during the 1971 season. Dr. Lund will supervise studies on IQB for canning. These will include actual on-line tests in a commercial canning plant. Also during the 1971 season, engineer John L. Bomben and chemists William C. Dietrich and Harry J. Newmann from the ARS Berkeley laboratory will conduct tests in several frozen food processing plants in California.

Application has been made to patent the IQB process. □

This structure, utilizing spray foam construction, would measure 312 feet across with a work area 80 feet in diameter. Bins would range from 11 feet wide at the center to 37 feet wide at the outside (PN–1969).

Potatoes-in-the-round

A REVOLUTIONARY CONCEPT in potato storage layouts is becoming a reality.

At a time when land space has become a precious commodity, a circular potato storage structure offers greater utilization of space than the rectangular configurations presently used, and it can be operated more efficiently and economically.

Conceived by ARS agricultural engineer Paul H. Orr, East Grand Forks, Minn., the circular storage structure's fundamental advantage over conventional rectangular structures is its shape.

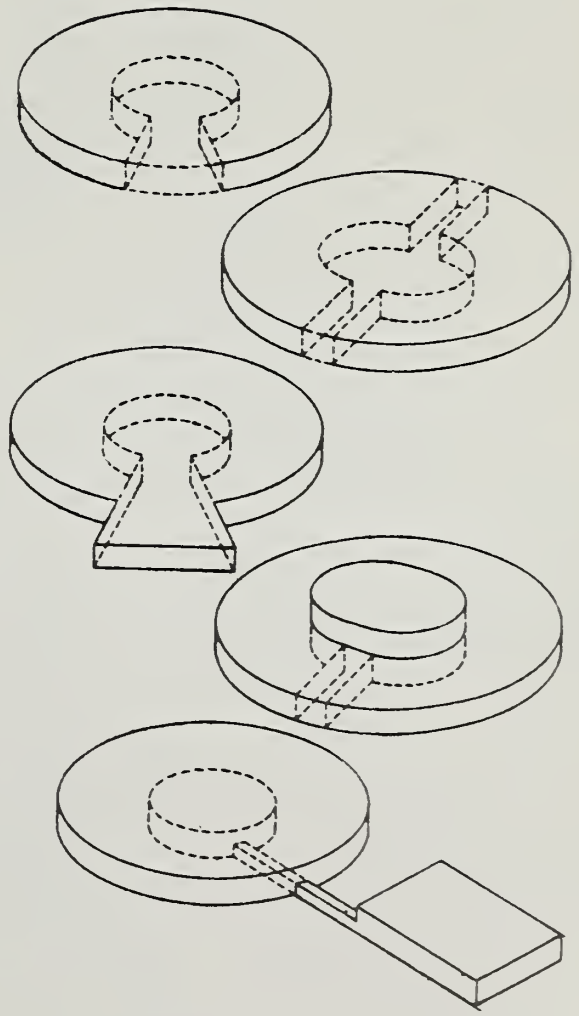
A circle provides a maximum of volume within a minimum perimeter. For example, a square structure with an 800-foot perimeter and a 20-foot height has a storage capacity (volume) of 800,000 cubic feet, while a circular structure with the same perimeter and height provides 1,018,589 cubic feet.

Usual potato storage facilities consist of a series of bins located on both sides of a central line to form an alleyway. The circular configuration locates the bins equidistant from a central point to form an inner circle of open space within the outer structure. This space serves as a work area.

The circular structure can also be filled and emptied more efficiently than the rectangular one. Under present harvesting and filling methods, several storage bins are rapidly filled simultaneously from several sources. This involves much equipment and activity in the work area. However, bins are generally emptied one at a time at a relatively slow rate to a single location, with very little equipment or activity involved. Because of its centrally located and compact work area, the layout provides maximum space for filling and minimum space for emptying.

Transportation facilities can be easily accommodated for a circular layout in several ways. Perhaps the easiest method would be a spur rail track entering the building along a radius of the circle.

One firm is developing a circular storage structure based on Mr. Orr's concept, and a group of growers planning a new storage area is strongly in favor of using the circular design. □



Possible arrangements of work and packing areas and office facilities. Rail and truck loading could be enclosed with the center providing overhead office space (PN–1970).

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Exposing chicks to Marek's disease

Natural exposure as a strategy to protect young chickens against Marek's disease (MD) just does not work.

In some poultry-growing areas it has become a common practice to put old litter with baby chicks under each brooder stove or to place a few old hens in with the chicks. It is usually hoped that this "controlled" exposure will reduce later outbreaks of MD, a tumorous disease of chickens.

The practice was tested by ARS poultry scientists H. Graham Purchase, William Okazaki, and Ben R. Burmester at the Regional Poultry Research Laboratory, East Lansing, Mich., and Marius Ianconescu, formerly with ARS.

In two experiments litter was used for the exposure and, in one, a number of adult birds.

Chicks were raised either on the farm or in isolation. Resistance acquired from exposure was challenged with injections of Marek's disease virus or contact exposure from chickens with Marek's disease. The natural exposure should cause antibodies to be produced. The chicks would thus develop resistance and be protected from subsequent infection.

Results indicated that farm-reared (exposed) birds were as prone to MD effects as chickens raised in isolation.

"The presence of actively acquired antibody does not confer any significant degree of protection against MD," the scientists concluded. They found that susceptibility to the challenge injection decreased with age. Birds injected at 5 weeks of age were 94 percent susceptible, while 12-week-old chickens were only 50 percent susceptible.

Since birds raised in isolation showed the same age effect, reduced susceptibility could not be attributed to natural exposure.

Controlling aquatic weeds

Diquat and paraquat provide excellent experimental control of the aquatic weeds southern naiad, marine naiad, and widgeongrass without harming fish or their environment.

These weeds obstruct water flow, cause large water losses through transpiration, and prevent proper drainage of land. Further, the weeds may interfere with navigation, prevent fishing and recreation, depress real estate values, and contribute to health hazards.

In studies spanning 3 years at Fort Lauderdale, Fla., ARS botanist Robert D. Blackburn and technician Thomas M. Taylor evaluated the two compounds in treatments of ½- and ¾-acre pounds. One application each year of 1 part per million by weight of diquat and paraquat controlled the weeds and had no effect on total fish production.

In assays for residues, the researchers found only traces of the chemicals in pond soil 30 days after treatment. The longest that any chemical remained in pond water was 14 days after treatment. Fish and plant analyses are now being conducted.

Examination of adult fish at the end of the tests revealed they suffered no ill effects from the treatments.

Both compounds initially affected the plankton and benthos organisms in the ponds, but the organisms recovered within 30 days after the treatment. Also, alkalinity, nitrate, and phosphorus content in the water were affected only temporarily.

Diquat is registered for use on aquatic weeds. Paraquat is not. Additional studies are needed to determine and evaluate any factors that might adversely affect the environment.

When this magazine reports research involving pesticides, it is not implied that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.